

Claims

1. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a positive electrode plate and a negative electrode plate provided opposed to each other with a separating material interposed therebetween, and lead terminals electrically connected to said electrode plates, respectively, i.e., positive electrode lead terminal and negative electrode lead terminal; and

a battery case made of a resin sheet which is open in one or two directions prior to sealing and is sealed by welding the openings with said electricity-generating element received therein and said lead terminals inserted in one of said openings.

(The foregoing resin sheet comprises an oriented resin layer provided on both surfaces of a metal layer.)

2. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a positive electrode plate and a negative electrode plate provided opposed to each other with a separating material interposed therebetween, and lead terminals electrically connected to said electrode plates, respectively, i.e., positive electrode lead terminal and negative electrode lead terminal; and

a battery case made of a resin sheet which is open in one or two directions prior to sealing and is sealed by welding the openings with said electricity-generating element received therein and said lead terminals inserted in one of said

openings.

(A molten and solidified resin mass is formed protruding from the inner end of the welded portion of the imposed edges of the opening toward the inner space of the battery by 0.1 mm or more.)

3. The nonaqueous secondary electrolytic battery according to Claim 2, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

4. The nonaqueous secondary electrolytic battery according to Claim 2, wherein the thickness of the welded portion of the imposed edges of the opening of said battery case is greater at the inner end thereof than at the outer end thereof.

5. The nonaqueous secondary electrolytic battery according to Claim 3, wherein the thickness of the welded portion of the imposed edges of the opening of said battery case is greater at the inner end thereof than at the outer end thereof.

6. The nonaqueous secondary electrolytic battery according to Claim 2, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

7. The nonaqueous secondary electrolytic battery according to Claim 3, wherein the resin sheet constituting said

battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

8. The nonaqueous secondary electrolytic battery according to Claim 4, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

9. The nonaqueous secondary electrolytic battery according to Claim 5, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

10. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a positive electrode plate and a negative electrode plate provided opposed to each other with a separating material interposed therebetween, and lead terminals electrically connected to said electrode plates, respectively, i.e., positive electrode lead terminal and negative electrode lead terminal; and

a battery case made of a resin sheet which is open in one or two directions prior to sealing and is sealed by welding the openings with said electricity-generating element received therein and said lead terminals inserted in one of said openings.

(The thickness of the welded portion of the imposed edges of the opening of said battery case is greater at the inner end thereof than at the outer end thereof.)

11. The nonaqueous secondary electrolytic battery according to Claim 10, wherein said electricity-generating

element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

12. The nonaqueous secondary electrolytic battery according to Claim 10, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

13. The nonaqueous secondary electrolytic battery according to Claim 11, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

14. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a positive electrode plate and a negative electrode plate provided opposed to each other with a separating material interposed therebetween, and lead terminals electrically connected to said electrode plates, respectively, i.e., positive electrode lead terminal and negative electrode lead terminal; and

a bag-shaped battery case made of a resin sheet sealed with said electricity-generating element received therein.

(In order to form this battery case, two parallel sides of a rectangular resin sheet are opposed and welded to each other to form a cylinder which is open in two directions (this welded portion will be hereinafter referred to as "welded portion X").

With the lead terminals of the foregoing electricity-generating element put in one of the two openings, the two edges of the openings are then opposed and welded to each other to form a sealed bag, thereby forming a structure having the surface of the welded portion X fixed to the surface of the battery case. The surface of the welded portion X is fixed to the surface of the battery case.)

15. The nonaqueous secondary electrolytic battery according to Claim 14, wherein one end of said welded portion X lies between said positive electrode lead terminal and said negative electrode lead terminal.

16. The nonaqueous secondary electrolytic battery according to Claim 14, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

17. The nonaqueous secondary electrolytic battery according to Claim 15, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

18. The nonaqueous secondary electrolytic battery

according to Claim 14, wherein the thickness of the welded portion of the imposed edges of the opening of said battery case is greater at the inner end thereof than at the outer end thereof.

19. The nonaqueous secondary electrolytic battery according to Claim 15, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

20. The nonaqueous secondary electrolytic battery according to Claim 16, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

21. The nonaqueous secondary electrolytic battery according to Claim 17, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

22. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a positive electrode plate and a negative electrode plate provided opposed to each other with a separating material interposed therebetween, and lead terminals electrically connected to said electrode plates, respectively, i.e., positive electrode lead terminal and negative electrode lead terminal; and

a bag-shaped battery case made of a resin sheet sealed with said electricity-generating element received therein.

(In order to form this battery case, two parallel sides of a rectangular resin sheet are opposed and welded to each other to form a cylinder which is open in two directions (this welded

portion will be hereinafter referred to as "welded portion X"). With the lead terminals of the foregoing electricity-generating element put in one of the two openings, the two edges of the openings are then opposed and welded to each other to form a sealed bag, thereby forming a structure having the surface of the welded portion X fixed to the surface of the battery case (the portion welded with the lead terminals put therein will be hereinafter referred to as "welded portion Y", and the other welded portion will be hereinafter referred to as "welded portion Z"). The surface of the welded portion X is fixed to the surface of the welded portion Y and/or welded portion Z.)

23. The nonaqueous secondary electrolytic battery according to Claim 22, wherein one end of said welded portion X lies between said positive electrode lead terminal and said negative electrode lead terminal.

24. The nonaqueous secondary electrolytic battery according to Claim 22, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

25. The nonaqueous secondary electrolytic battery according to Claim 23, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the

winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

26. The nonaqueous secondary electrolytic battery according to Claim 22, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

27. The nonaqueous secondary electrolytic battery according to Claim 23, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

28. The nonaqueous secondary electrolytic battery according to Claim 24, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

29. The nonaqueous secondary electrolytic battery according to Claim 25, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

30. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a positive electrode plate and a negative electrode plate wound with a separating material interposed therebetween in such an arrangement that the section perpendicular to the winding axis is ellipsoidal and lead terminals electrically connected to said positive electrode plate and said negative electrode plate, respectively, and drawn from the end face perpendicular to the

winding axis, i.e., positive electrode lead terminal and negative electrode lead terminal;

a fixing tape wound on said electricity-generating element along the winding axis extending from the peripheral surface of said electricity-generating element to said end face and running through the gap between said positive electrode lead terminal and said negative electrode lead terminal; and

a bag-shaped battery case made of a resin sheet sealed with said electricity-generating element received therein.

(In order to form this battery case, two parallel sides of a rectangular resin sheet are opposed and welded to each other to form a cylinder which is open in two directions (this welded portion will be hereinafter referred to as "welded portion X"). With the lead terminals of the foregoing electricity-generating element put in one of the two openings, the two edges of the openings are then opposed and welded to each other to form a sealed bag, thereby forming a structure having the surface of the welded portion X fixed to the surface of the battery case. The welded portion X is formed overlapping partially the fixing tape.)

31. The nonaqueous secondary electrolytic battery according to Claim 30, wherein said electricity-generating element is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of said opening.

32. The nonaqueous secondary electrolytic battery according to Claim 30, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil

and a resin layer laminated on each other.

33. The nonaqueous secondary electrolytic battery according to Claim 31, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

34. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a positive electrode plate and a negative electrode plate provided opposed to each other with a separating material interposed therebetween and lead terminals electrically connected to said electrode plates, respectively; and

a battery case made of a resin sheet which is open in one or two directions prior to sealing and is sealed by welding the openings with said electricity-generating element received therein and said lead terminals inserted in one of said openings.

(The foregoing lead terminals are each bent at a radius of from 0.5 mm to 4 mm.)

35. The nonaqueous secondary electrolytic battery according to Claim 34, wherein the bent portion of said lead terminals is covered by a resin layer.

36. The nonaqueous secondary electrolytic battery according to Claim 35, wherein the resin layer by which said lead terminals are covered is made of a resin tube different from said battery case.

37. The nonaqueous secondary electrolytic battery according to Claim 35, wherein the resin layer by which said

lead terminals are covered comprises a lead covering portion formed by partially extending the resin sheet constituting said battery case.

38. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a positive electrode plate and a negative electrode plate provided opposed to each other with a separating material interposed therebetween and lead terminals electrically connected to said electrode plates, respectively; and

a battery case made of a resin sheet which is open in one or two directions prior to sealing and is sealed by welding the openings with said electricity-generating element received therein and said lead terminals inserted in one of said openings.

(The inner pressure of the battery case thus sealed is predetermined lower than 760 mmHg.)

39. The nonaqueous secondary electrolytic battery according to Claim 38, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

40. The nonaqueous secondary electrolytic battery according to Claim 38, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil

and a resin layer laminated on each other.

41. The nonaqueous secondary electrolytic battery according to Claim 39, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

42. A nonaqueous secondary electrolytic battery comprising the following elements:

an electricity-generating element comprising a belt-like positive electrode plate and a belt-like negative electrode plate wound with a separating material interposed therebetween and lead terminals drawn from the end face perpendicular to the winding axis and electrically connected to said positive electrode plate and said negative electrode plate, respectively, i.e., positive electrode lead terminal and negative electrode lead terminal (The foregoing positive electrode plate comprises a positive electrode compound applied to a belt-like collector and has an exposed collector area at one longitudinal end thereof. The foregoing positive electrode lead terminal is connected to the exposed area.

The foregoing negative electrode plate comprises a negative electrode compound applied to a belt-like collector and has an exposed collector area at one longitudinal end thereof. The foregoing negative electrode lead terminal is connected to the exposed area.

An insulating tape having a length greater than the width of said electrode plates is stuck to at least one of said positive electrode plate and negative electrode plate with an adhesive layer interposed therebetween. The forming length of the

adhesive layer is shorter than the width of said electrode plates and doesn't protrude from said electrode plates.); and

a bag-shaped battery case made of a resin sheet sealed with said electricity-generating element received therein.

43. The nonaqueous secondary electrolytic battery according to Claim 42, wherein when said positive electrode plate and negative electrode plate have been wound with said separating material interposed therebetween, said insulating tape is disposed at the position corresponding to the exposed area of said collector of the other electrode plate and said lead terminals.

44. The nonaqueous secondary electrolytic battery according to Claim 42, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

45. The nonaqueous secondary electrolytic battery according to Claim 43, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

46. The nonaqueous secondary electrolytic battery

according to Claim 42, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

47. The nonaqueous secondary electrolytic battery according to Claim 43, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

48. The nonaqueous secondary electrolytic battery according to Claim 44, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

49. The nonaqueous secondary electrolytic battery according to Claim 45, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

50. A process for the preparation of a nonaqueous secondary electrolytic battery comprising an electricity-generating element comprising a positive electrode plate and a negative electrode plate provided opposed to each other with a separating material interposed therebetween, and lead terminals electrically connected to said electrode plates, respectively, i.e., positive electrode lead terminal and negative electrode lead terminal and a battery case made of a resin sheet for receiving said electricity-generating element therein from which said lead terminals are drawn to the exterior thereof through the sealed portion of said resin sheet, which comprises receiving said electricity-generating element and an insulating foam-preventive material in said battery case which

is open in two directions before sealing in the direction along the winding axis of said electricity-generating element, sealing the opening at which said foam-preventive material is not provided, injecting an electrolytic solution into said battery case through the opening at which said foam-preventive material is provided, and then welding the opposing edges of said opening to each other while said battery case is being evacuated.

51. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 50, wherein said foam-preventive material is disposed in the direction of the winding axis of said electricity-generating element on the side of said electricity-generating element opposite the lead terminal drawing portion.

52. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 51, wherein said foam-preventive material is fixed to said electricity-generating element on the side thereof opposite the lead terminal drawing portion.

53. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 50, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

54. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 51, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

55. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 52, wherein said electricity-generating element is formed by winding said positive electrode plate and negative electrode plate on its winding axis in such an arrangement that the section almost perpendicular to the winding axis is ellipsoidal and is received in said battery case in such an arrangement that the winding axis is perpendicular to the plane of the opening of the battery case.

56. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 50, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

57. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 51, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

58. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 52, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

59. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 53, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

60. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 54, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.

61. The process for the preparation of a nonaqueous secondary electrolytic battery according to Claim 55, wherein the resin sheet constituting said battery case is a metal-laminated film comprising a metal foil and a resin layer laminated on each other.